Avaya Solution & Interoperability Test Lab

Configuring Juniper Networks J4300 and Cisco 1841 Routers to use compressed Real Time Protocol over Point-to-Point Protocol to Support an Avaya IP Telephony Infrastructure – Issue 1.0

Abstract

These Application Notes describe the steps for configuring Juniper Networks J4300 and Cisco Systems 1841 routers to use compressed RTP (cRTP) over a Point-to-Point Protocol (PPP) connection to support an Avaya IP Telephony infrastructure. The Avaya IP Telephony infrastructure consists of Avaya Media Server, Avaya Media Gateways, and Avaya IP Telephones. The Juniper Networks and Cisco routers will perform header compression for all RTP packets traversing over the PPP connection to minimize overhead and increasing available bandwidth.

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1. Introduction

RTP packets generated by Voice over IP (VoIP) telephony are typically small in size ranging in tens of bytes per packet. Various headers such as IP (20 bytes) and UDP (8 bytes) are then added onto each packet before transmission. Because of the relative small packet size of RTP packet, the IP and UDP headers compose a large percentage of overhead in each frame. For RTP packets that traverse a Wide Area Network (WAN) that has a small bandwidth, The IP and UDP headers represents an opportunity for bandwidth saving that could otherwise be used for other traffic or additional VoIP calls. The compression of RTP header is known as cRTP for short.

Figure 1, illustrate the configuration used in these Application Notes. Two separate IP networks, one in each location are connected together by a Juniper Networks J4300 and Cisco 1841 routers over a PPP connection. Each location contains an Avaya Media Server, an Avaya Media Gateway, and Avaya IP Telephones. A H.323 trunk configured between the two Avaya Media Servers running Avaya Communication Manager allows calls to be routed between the two systems. Both the Juniper Networks J4300 and Cisco 1841 routers are configured to perform RTP header compression for all RTP packets traversing over the PPP connection. Both routers are configured to prioritize VoIP traffic based on DiffServ Code Point (DSCP) information encoded in each VoIP packet. Bandwidth allocation was set on all interfaces shown to guarantee that the necessary bandwidth is reserved for VoIP traffic in the event of network congestion.

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2. Configuration

Telephones with the extension range of 3xxxx are registered with the Avaya S8300 Media Server on the right side of the figure, and telephones with extension range of 2xxxx are registered with Avaya S8500 Media Server on the left side of the figure. A uniform dial plan and an H.323 IP trunk was used to route calls between the two Avaya Media Servers. IP addresses for all the devices are statically administered.

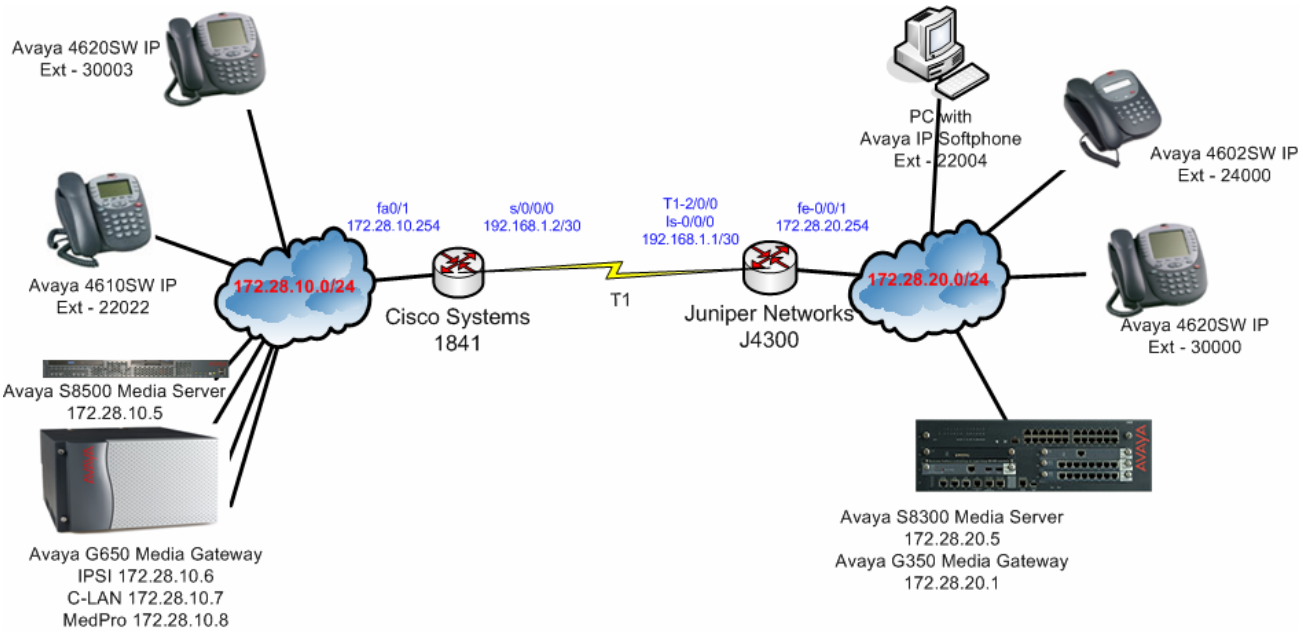

Figure 1: Sample Network Configuration

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3. Equipment and Software Validated

The following equipment and software/firmware were used for the sample configuration:

Equipment	Software/Firmware
Avaya S8300 Media Server with G350 Media Gateway	Avaya Communication Manager 3.1 (R013x.01.0.626.0)
Avaya S8500 Media Server	Avaya Communication Manager 3.1 (R013x.01.0.626.0)
Avaya G650 Media Gateway	-
TN2312BP IPSI	HW03 FW009
TN799DP C-LAN	HW01 FW015
TN2302AP IP MedPro	HW18 FW108
Avaya 4602SW IP Telephone (H.323)	R2.3 – Application (a02d01b2_3.bin)
Avaya 4610SW IP Telephone (H.323)	R2.3 – Application (a10d01b2_3.bin)
Avaya 4620SW IP Telephone (H.323)	R.2.3 – Application (a20d01b2_3.bin)
Avaya IP Softphone	5.24.8
Juniper Networks J4300 router	JUNOS 7.6R2.6
Cisco Systems 1841 router	IOS 12.3(8)T6

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4. Avaya Communication Manager

There is no unique configuration required in Avaya Communication Manager to support compressed RTP (cRTP) or any feature(s) mentioned in this document. For detailed information on the Installation, Maintenance, and Configuration of Avaya Communication Manager, please consult reference [5], [2], and [3].

Step	Description
1.	Below is the output from **display ip-network-region** from the SAT terminal of Avaya Communication Manager. This display shows the **MEDIA PARAMETERS** and **DIFFSERV/TOS PARAMETERS** information configured in Avaya Communication Manager. The **MEDIA PARAMETERS** information will be needed in Section 5.1 Step 6 and the **DIFFSERV/TOS PARAMETERS** information will be in Section 5.1 Step 3 and Section 5.2 Step 2. Note: The **Call Control PHB Value** of **34** is equivalent to 100010 in binary. The **Audio PHB Value** of **46** is equivalent to 101110 in binary. **display ip-network-region 1** Page 1 of 19 IP NETWORK REGION Region: 1 Location: Authoritative Domain: Name: **MEDIA PARAMETERS** Intra-region IP-IP Direct Audio: yes Codec Set: 1 Inter-region IP-IP Direct Audio: yes **UDP Port Min: 2048** IP Audio Hairpinning? n **UDP Port Max: 3029** **DIFFSERV/TOS PARAMETERS** RTCP Reporting Enabled? y **Call Control PHB Value: 34** RTCP MONITOR SERVER PARAMETERS **Audio PHB Value: 46** Use Default Server Parameters? y Video PHB Value: 26 802.1P/Q PARAMETERS Call Control 802.1p Priority: 6 Audio 802.1p Priority: 6 Video 802.1p Priority: 5 AUDIO RESOURCE RESERVATION PARAMETERS H.323 IP ENDPOINTS RSVP Enabled? n H.323 Link Bounce Recovery? y Idle Traffic Interval (sec): 20 Keep-Alive Interval (sec): 5 Keep-Alive Count: 5

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5. Configure the Networks Routers

The following sections describe steps for configuring the Juniper Networks J4300 and Cisco Systems 1841 routers in the sample configuration.

5.1. Configure the Juniper Networks J4300 router.

This section shows the necessary steps in configuring the Juniper Networks J4300 router as shown in the sample network. The following steps use the Command Line Interface (CLI) of the J4300 router. Unless other wise specified, all routers configuration are based on Juniper Networks recommendation.

Step	Description

1.	Connect to the J4300. Log in using the appropriate Login ID and Password.
	
	`login:`
	`Password:`
	
	The following prompt will appears after successful log in.
	
	`interop@J4300>`

2.	Enter configuration mode by typing in **edit** at the prompt.
	
	`interop@J4300> edit`
	`interop@J4300#`

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Step	Description

3.	Configure the **code-point-aliases** and **classifier** for Avaya VoIP traffic.
	
	• The alias helps identify the binary DSCP setting by giving it a name.
	• The sample network uses the name "avaya-rtp" to denote the dscp binary bit 101110 for media traffic. This is equivalent to the decimal vale of 46 set in Avaya Communication Manager for RTP Media in Section 4, Step 1.
	• The sample network uses the name "avaya-sig" to denote dscp binary bit 100010 for signaling traffic. This is equivalent to the decimal vale of 34 set in Avaya Communication Manager for signaling in Section 4, Step 1.
	
	`interop@J4300# edit class-of-service code-point-aliases`
	`interop@J4300# set dscp avaya-rtp 101110`
	`interop@J4300# set dscp avaya-sig 100010`
	`interop@J4300# exit`
	
	• Define a **classifier** called "Avaya-voip".
	• The **classifier** "Avaya-voip" defines the forwarding characteristic of the router based on traffic types.
	• The sample configuration is configured to use expedited-forwarding with low loss-priority for "avaya-rtp", and assured-forwarding with low loss-priority for "avaya-sig".
	
	`interop@J4300# edit class-of-service classifiers`
	`interop@J4300# edit dscp Avaya-voip`
	`interop@J4300# set forwarding-class expedited-forwarding loss-priority low code-points avaya-rtp`
	`interop@J4300# set forwarding-class assured-forwarding loss-priority low code-points avaya-sig`
	`interop@J4300# exit`

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Step	Description

4.	Configure the scheduler to specify how much bandwidth to allocate for each type of traffic queue.
	
	• The sample configuration defines a **scheduler-maps** called "voip", and assign a name for each of the 4 queues types.
	
	`interop@J4300# edit class-of-service scheduler-maps`
	`interop@J4300# edit voip`
	`interop@J4300# set forwarding-class best-effort scheduler be-sched`
	`interop@J4300# set forwarding-class expedited-forwarding scheduler ef-sched`
	`interop@J4300# set forwarding-class assured-forwarding scheduler af-sched`
	`interop@J4300# set forwarding-class network-control scheduler nc-sched`
	`interop@J4300# exit`
	`interop@J4300# exit`
	
	• Use the scheduler to define the percentage of bandwidth allocation to each traffic queue type.
	
	`interop@J4300# edit class-of-service schedulers`
	`interop@J4300# edit be-sched`
	`interop@J4300# set transmit-rate percent 10`
	`interop@J4300# set buffer-size percent 10`
	`interop@J4300# set priority low`
	`interop@J4300# exit`
	`interop@J4300# edit ef-sched`
	`interop@J4300# set transmit-rate percent 80`
	`interop@J4300# set buffer-size percent 80`
	`interop@J4300# set priority high`
	`interop@J4300# exit`
	`interop@J4300# edit af-sched`
	`interop@J4300# set transmit-rate percent 5`
	`interop@J4300# set buffer-size percent 5`
	`interop@J4300# set priority high`
	`interop@J4300# exit`
	`interop@J4300# edit nc-sched`
	`interop@J4300# set transmit-rate percent 5`
	`interop@J4300# set buffer-size percent 5`
	`interop@J4300# set priority high`
	`interop@J4300# exit`

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Step	Description

5.	Assign the scheduler-map to each interface.
	
	• Configure each interface with **scheduler-map** voip using the classifier defined above.
	
	`interop@J4300# edit class-of-service interfaces fe-0/0/1`
	`interop@J4300# set unit 0 scheduler-map voip`
	`interop@J4300# set unit 0 classifiers dscp avaya-voip`
	`interop@J4300# exit`
	`interop@J4300# edit class-of-service interfaces ls-0/0/0`
	`interop@J4300# set unit 0 scheduler-map voip`
	`interop@J4300# set unit 0 classifiers dscp avaya-voip`
	`interop@J4300# exit`
	`interop@J4300# edit class-of-service interfaces t1-2/0/0`
	`interop@J4300# set unit 0 scheduler-map voip`
	`interop@J4300# set unit 0 classifiers dscp avaya-voip`
	`interop@J4300# exit`

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Step	Description

6.	Configure the Ethernet and T1 interfaces.
	
	• Configure the Ethernet interface to use the scheduler.
	• Assign an IP address to the interface.
	
	`interop@J4300# edit int fe-0/0/1`
	`interop@J4300# set per-unit-scheduler`
	`interop@J4300# set unit 0 family inet address 172.28.20.254/24`
	`interop@J4300# exit`
	
	• Configure the logical interface for the WAN connection to use the scheduler.
	• Assign an IP address to the interface.
	• Specify the RTP traffic to be compressed. The sample configuration defines RTP traffic with port UDP range 2048 to 3029 to be compressed. This port range needs to match to **UDP Port Min** and **UDP Port Max** configured in Avaya Communication Manager in Section 4, Step 1.
	
	`interop@J4300# edit int ls-0/0/0`
	`interop@J4300# set per-unit-scheduler`
	`interop@J4300# set unit 0 compression rtp port min 2048 max 3029`
	`interop@J4300# set unit 0 family inet 192.168.1.1/30`
	`interop@J4300# exit`
	
	• Configure the T1 interface to use the scheduler.
	• Configure the T1 interface timing, encapsulation, and timeslots.
	• Configure the T1 interface to use logical interface ls-0/0/0.0 defined above. An IP address is not necessary because an IP address is already defined for the logical interface.
	
	`interop@J4300# edit int t1-2/0/0`
	`interop@J4300# set per-unit-scheduler`
	`interop@J4300# set clocking internal`
	`interop@J4300# set encapsulation ppp`
	`interop@J4300# set t1-options timeslots 1-24`
	`interop@J4300# set unit 0 compression-device ls-0/0/0.0`
	`interop@J4300# exit`

7.	Configure the routing options for the J4300 router. The sample configuration uses static routes.
	
	`interop@J4300# edit routing-options static`
	`interop@J4300# route 172.28.10.0/24 next-hop 192.168.1.1`
	`interop@J4300# exit`

8.	Save the changes. `interop@J4300# commit`

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5.2. Configure the Cisco System 1841 router

This section shows the necessary steps in configuring the Cisco 1841 router as shown in the sample network. The following steps use the Command Line Interface (CLI) of the Cisco 1841 router.

Step	Description

1.	Connect to the Cisco 1841 router. Log in using the appropriate Password. Enter into enable mode using the appropriate enabled password. Enter the configuration mode by typing in "configure terminal"
	
	`Password:`
	`Cisco1841>`*`en`*
	`Password:`
	`Cisco1841#` *`configure terminal`*
	`Cisco1841(config)#`

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Step	Description

2.	Configure a class-map to define VoIP traffic.
	
	• The sample configuration uses the dscp value of the VoIP packet to define two class-map. One called “avaya-rtp”, and the other “avaya-sig”.
	• Use the DSCP equivalent value set in Section 4, Step 1.
	
	`Cisco1841(config)# class-map match-any avaya-rtp`
	`Cisco1841(config-cmap)# match ip dscp ef`
	`Cisco1841(config-cmap)# match protocol rtp`
	`Cisco1841(config)# class-map match-all avaya-sig`
	`Cisco1841(config-cmap)# match ip dscp af41`
	`Cisco1841(config-cmap)# exit`
	
	• Use the “?” key after “match ip dscp” to display a list of possible DSCP values.
	
	`Cisco1841(config-cmap)# match ip dscp ?`
	`<0-63> Differentiated services codepoint value`
	`af11 Match packets with AF11 dscp (001010)`
	`af12 Match packets with AF12 dscp (001100)`
	`af13 Match packets with AF13 dscp (001110)`
	`af21 Match packets with AF21 dscp (010010)`
	`af22 Match packets with AF22 dscp (010100)`
	`af23 Match packets with AF23 dscp (010110)`
	`af31 Match packets with AF31 dscp (011010)`
	`af32 Match packets with AF32 dscp (011100)`
	`af33 Match packets with AF33 dscp (011110)`
	`af41 Match packets with AF41 dscp (100010)`
	`af42 Match packets with AF42 dscp (100100)`
	`af43 Match packets with AF43 dscp (100110)`
	`cs1 Match packets with CS1(precedence 1) dscp (001000)`
	`cs2 Match packets with CS2(precedence 2) dscp (010000)`
	`cs3 Match packets with CS3(precedence 3) dscp (011000)`
	`cs4 Match packets with CS4(precedence 4) dscp (100000)`
	`cs5 Match packets with CS5(precedence 5) dscp (101000)`
	`cs6 Match packets with CS6(precedence 6) dscp (110000)`
	`cs7 Match packets with CS7(precedence 7) dscp (111000)`
	`default Match packets with default dscp (000000)`
	`ef Match packets with EF dscp (101110)`

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Step	Description

3.	Define a policy-map to perform bandwidth allocation. The sample network defined a policy-map called avaya-voip with 5% bandwidth allocated for signaling, 70% bandwidth allocated for RTP, and the remaining bandwidth for the rest of the traffic. 70% is the maximum bandwidth allocation that can be defined for a particular type of traffic in the Cisco 1841 router.
	
	• Compress RTP must be enabled using a policy map. The alternative method of enabling ip rtp header compression at the interface level will not interoperate with the Juniper router as it also enables TCP header compression automatically.
	
	`Cisco1841(config)# policy-map avaya-voip`
	`Cisco1841(config-pmap)# class avaya-sig`
	`Cisco1841(config-pmap-c)# bandwidth percent 5`
	`Cisco1841(config-pmap-c)# class avaya-rtp`
	`Cisco1841(config-pmap-c)# bandwidth percent 70`
	`Cisco1841(config-pmap-c)# compress header ip rtp`
	`Cisco1841(config-pmap-c)# class class-default`
	`Cisco1841(config-pmap-c)# fair-queue`
	`Cisco1841(config-pmap-c)# exit`
	`Cisco1841(config-pmap-c)# exit`

4.	Configure the Ethernet and T1 interfaces. Apply the policy-map avaya-voip to the serial interface.
	
	`Cisco1841(config)# int fa0/1`
	`Cisco1841(config-if)# ip address 172.28.10.254 255.255.255.0`
	`Cisco1841(config-if)# Serial0/0/0`
	`Cisco1841(config-if)# ip address 192.168.1.2 255.255.255.252`
	`Cisco1841(config-if)# service-policy output avaya-voip`
	`Cisco1841(config-if)# encapsulation ppp`
	`Cisco1841(config-if)# service-module t1 timeslots 1-24`
	`Cisco1841(config-if)# exit`

5.	Configure routing. Static routes were used in the sample configuration.
	
	`Cisco1841(config)# ip route 172.28.20.0 255.255.255.0 192.168.1.1`
	`Cisco1841(config)# ip default-gateway 192.168.1.1`

6.	Save the configuration.
	
	`Cisco1841(config)# exit`
	`Cisco1841(config)# write mem`

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6. Verification Steps

The following steps may be used to verify the configuration.

Step	Description
1.	Verify network connectivity using "ping" from the PC. All network devices including Avaya IP Telephones should be reachable including network devices across the WAN connection.
2.	Place calls between Avaya IP Telephones across the two IP networks. Verify calls can be established and maintained.

3.	From the Juniper J4300 router, use the **show service crtp flow** command to verify that traffic is being compressed. For an active phone call, there should be at least two flows displayed, one transmit and one receive.
	
	`interop@J4300> show services crtp flows`
	`Interface: Interface: ls-0/0/0.0`
	`  Flow  Source  Destination  SSRC ID  Ctx ID`
	`  Transmit  172.28.20.128:2300  172.28.10.128:2594  1847753485  7`
	`  Receive  172.28.10.128:2594  172.28.20.128:2300  327775943  80`

4.	From the Juniper J4300 router, use the **show interface queue** command to verify traffic is being forwarded via the correct queue. The output below shows the information of an active phone call (50pps) being sent out queue 1 (expedited-forwarding queue).
	
	`interop@J4311> show interfaces queue t1-2/0/0`
	`Physical interface: t1-2/0/0, Enabled, Physical link is Up`
	`  Interface index: 139, SNMP ifIndex: 34`
	`Forwarding classes: 8 supported, 8 in use`
	`Egress queues: 8 supported, 8 in use`
	`Queue: 0, Forwarding classes: best-effort`
	`  Queued:`
	`  Packets : 173342 150 pps`
	`  Bytes : 40575543 1784400 bps`
	`  Transmitted:`
	`  Packets : 170196 124 pps`
	`  Bytes : 35897441 1484048 bps`
	`  Tail-dropped packets : 0 0 pps`
	`  RED-dropped packets : 3144 25 pps`
	`  Low : 3144 25 pps`
	`  Medium-low : 0 0 pps`
	`  Medium-high : 0 0 pps`
	`  High : 0 0 pps`
	`  RED-dropped bytes : 4675128 300344 bps`
	`  Low : 4675128 300344 bps`
	`  Medium-low : 0 0 bps`
	`  Medium-high : 0 0 bps`
	`  High : 0 0 bps`
	`Queue: 1, Forwarding classes: expedited-forwarding`
	`  Queued:`
	`  **Packets : 46978 50 pps**`
	`  Bytes : 2361646 25944 bps`
	`  Transmitted:`

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Step	Description

```
        Packets              :              46978                50 pps
        Bytes                :            2361646             25944 bps
        Tail-dropped packets :                  0                 0 pps
        RED-dropped packets  :                  0                 0 pps
         Low                 :                  0                 0 pps
         Medium-low          :                  0                 0 pps
         Medium-high         :                  0                 0 pps
         High                :                  0                 0 pps
        RED-dropped bytes    :                  0                 0 bps
         Low                 :                  0                 0 bps
         Medium-low          :                  0                 0 bps
         Medium-high         :                  0                 0 bps
         High                :                  0                 0 bps
    Queue: 2, Forwarding classes: assured-forwarding
      Queued:
        Packets              :             217241                 0 pps
        Bytes                :           12011825                 0 bps
      Transmitted:
        Packets              :             217241                 0 pps
        Bytes                :           12011825                 0 bps
        Tail-dropped packets :                  0                 0 pps
        RED-dropped packets  :                  0                 0 pps
         Low                 :                  0                 0 pps
         Medium-low          :                  0                 0 pps
         Medium-high         :                  0                 0 pps
         High                :                  0                 0 pps
        RED-dropped bytes    :                  0                 0 bps
         Low                 :                  0                 0 bps
         Medium-low          :                  0                 0 bps
         Medium-high         :                  0                 0 bps
         High                :                  0                 0 bps
    Queue: 3, Forwarding classes: network-control
      Queued:
        Packets              :               9722                 0 pps
        Bytes                :             141217                 0 bps
      Transmitted:
        Packets              :               9722                 0 pps
        Bytes                :             141217                 0 bps
        Tail-dropped packets :                  0                 0 pps
        RED-dropped packets  :                  0                 0 pps
         Low                 :                  0                 0 pps
         Medium-low          :                  0                 0 pps
         Medium-high         :                  0                 0 pps
         High                :                  0                 0 pps
        RED-dropped bytes    :                  0                 0 bps
         Low                 :                  0                 0 bps
         Medium-low          :                  0                 0 bps
         Medium-high         :                  0                 0 bps
         High                :                  0                 0 bps
```

5.	From the Juniper J4300 router, use the **show class-of-service forwarding-table** command to verify the bandwidth allocation has been assigned to each interface. The following output has been abbreviated to only show the relevant interfaces. The bandwidth allocation of bandwidth should match what is configured in Step 4 of Section 5.1.

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Step	Description

```
interop@J4300> show class-of-service forwarding-table
Classifier table index: 12, # entries: 8, Table type: IPv4 precedence
Entry #   Code point   Queue #   PLP
   0          000        0       0
   1          001        0       1
   2          010        0       0
   3          011        0       1
   4          100        0       0
   5          101        0       1
   6          110        3       0
   7          111        3       1

Classifier table index: 6440, # entries: 2, Table type: DSCP
Entry #   Code point   Queue #   PLP
   0        100010       2       0
   1        101110       1       0
                        Table Index/
Interface      Index      Q num      Table type
sp-0/0/0.16383    66         12      IPv4 precedence
ls-0/0/0.0        67       6440      DSCP
fe-0/0/0.0        68         12      IPv4 precedence
fe-0/0/1.0        69       6440      DSCP

Interface: ls-0/0/0, (Index: 134,, Map index: 2,, Map type: FINAL,, Num
of queue
s: 2):
Index: 0
  Entry 0 (Scheduler index: 17, Queue #: 0):
    Tx rate: 0 Kb (95%), Buffer size: 95 percent
Priority low
    PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
  Entry 1 (Scheduler index: 19, Queue #: 3):
    Tx rate: 0 Kb (5%), Buffer size: 5 percent
Priority low
    PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1

Interface: fe-0/0/1, (Index: 138,, Map index: 2,, Map type: FINAL,, Num
of queue
s: 2):
Index: 0
  Entry 0 (Scheduler index: 17, Queue #: 0):
    Tx rate: 0 Kb (95%), Buffer size: 95 percent
Priority low
    PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
  Entry 1 (Scheduler index: 19, Queue #: 3):
    Tx rate: 0 Kb (5%), Buffer size: 5 percent
Priority low
    PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1

Interface: t1-2/0/0, (Index: 139,, Map index: 2,, Map type: FINAL,, Num
of queue
s: 2):
Index: 0
  Entry 0 (Scheduler index: 17, Queue #: 0):
    Tx rate: 0 Kb (95%), Buffer size: 95 percent
Priority low
    PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
  Entry 1 (Scheduler index: 19, Queue #: 3):
    Tx rate: 0 Kb (5%), Buffer size: 5 percent
Priority low
    PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1

Interface: ls-0/0/0.0, (Index: 67,, Map index: 45418,, Map type: FINAL,,
```


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Step	Description

```
    Num of
    queues: 4):
    Index: 0
      Entry 0 (Scheduler index: 13005, Queue #: 0):
        Tx rate: 0 Kb (10%), Buffer size: 10 percent
    Priority low
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
      Entry 1 (Scheduler index: 62197, Queue #: 1):
        Tx rate: 0 Kb (80%), Buffer size: 80 percent
    Priority high
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
      Entry 2 (Scheduler index: 62165, Queue #: 2):
        Tx rate: 0 Kb (5%), Buffer size: 5 percent
    Priority high
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
      Entry 3 (Scheduler index: 45740, Queue #: 3):
        Tx rate: 0 Kb (5%), Buffer size: 5 percent
    Priority high
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1

    Interface: fe-0/0/1.0, (Index: 69,, Map index: 45418,, Map type: FINAL,,
    Num of
    queues: 4):
    Index: 0
      Entry 0 (Scheduler index: 13005, Queue #: 0):
        Tx rate: 0 Kb (10%), Buffer size: 10 percent
    Priority low
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
      Entry 1 (Scheduler index: 62197, Queue #: 1):
        Tx rate: 0 Kb (80%), Buffer size: 80 percent
    Priority high
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
      Entry 2 (Scheduler index: 62165, Queue #: 2):
        Tx rate: 0 Kb (5%), Buffer size: 5 percent
    Priority high
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
      Entry 3 (Scheduler index: 45740, Queue #: 3):
        Tx rate: 0 Kb (5%), Buffer size: 5 percent
    Priority high
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1

    Interface: t1-2/0/0.0, (Index: 70,, Map index: 45418,, Map type: FINAL,,
    Num of
    queues: 4):
    Index: 0
      Entry 0 (Scheduler index: 13005, Queue #: 0):
        Tx rate: 0 Kb (10%), Buffer size: 10 percent
    Priority low
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
      Entry 1 (Scheduler index: 62197, Queue #: 1):
        Tx rate: 0 Kb (80%), Buffer size: 80 percent
    Priority high
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
      Entry 2 (Scheduler index: 62165, Queue #: 2):
        Tx rate: 0 Kb (5%), Buffer size: 5 percent
    Priority high
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
      Entry 3 (Scheduler index: 45740, Queue #: 3):
        Tx rate: 0 Kb (5%), Buffer size: 5 percent
    Priority high
        PLP high: 1, PLP low: 1, PLP medium-high: 1, PLP medium-low: 1
```


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Step	Description
6.	From the Cisco 1841 router. Use the **show policy-map interface s0/0/0 output** to display the interface statistics and ensure that the policy-map is configured correctly. The bandwidth allocation of bandwidth should match what is configured in Step 3 of Section 5.2.

```
Cisco1841#show policy-map interface s0/0/0 output
 Serial0/0/0
  Service-policy output: avaya-voip

    Class-map: avaya-sig (match-all)
      246 packets, 14885 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match: ip dscp af41
      Queueing
        Output Queue: Conversation 265
        Bandwidth 5 (%)
        Bandwidth 76 (kbps) Max Threshold 64 (packets)
        (pkts matched/bytes matched) 190/12380
        (depth/total drops/no-buffer drops) 0/0/0

    Class-map: avaya-rtp (match-any)
      806789 packets, 164463693 bytes
      5 minute offered rate 653000 bps, drop rate 11000 bps
      Match: ip dscp ef
        898 packets, 182364 bytes
        5 minute rate 0 bps
      Match: protocol rtp
        805891 packets, 164281329 bytes
        5 minute rate 653000 bps
      Queueing
        Output Queue: Conversation 266
        Bandwidth 70 (%)
        Bandwidth 1075 (kbps) Max Threshold 64 (packets)
        (pkts matched/bytes matched) 713569/119861698
        (depth/total drops/no-buffer drops) 0/7888/0
      compress:
          header ip rtp
          UDP/RTP (compression on, IPHC)
            Sent:    806789 total, 806450 compressed,
                     28955604 bytes saved, 132280933 bytes sent
                     1.21 efficiency improvement factor
                     99% hit ratio, five minute miss rate 0
misses/sec, 1 max
                     rate 519000 bps

    Class-map: class-default (match-any)
      649063 packets, 710043532 bytes
      5 minute offered rate 0 bps, drop rate 0 bps
      Match: any
      Queueing
        Flow Based Fair Queueing
        Maximum Number of Hashed Queues 256
        (total queued/total drops/no-buffer drops) 0/237289/0
```


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7. Conclusion

These Application Notes have described the administration steps required to configure RTP header compression (cRTP) to interoperate between a Juniper Networks J4300 and a Cisco Systems 1841 router over a Point-to-Point Protocol (PPP) connection to support the Avaya IP Telephony infrastructure. Quality of Service was implemented by the use of DSCP information for traffic priority queue assignment, and the use of bandwidth allocation on all the interfaces. There was no detectable difference in voice quality between VoIP traffic that has gone through header compression to traffic that had not used header compression using both objective and subjective testing. Basic telephone features such as Transfer, Conference, and DTMF detection continue to function over a cRTP environment.

8. Additional References

Product documentation for Avaya products may be found at http://support.avaya.com

[1] *Administrator Guide for Avaya Communication Manager*, Doc # 03-300509, Issue 1, June 2005
[2] *Avaya Communication Manager Advanced Administration Quick Reference*, Doc # 03-300364, Issue 2, June 2005 Release 3.0
[3] *Administration for Network Connectivity for Avaya Communication Manager*, Doc # 555-233-504, Issue 6, May 2003
[4] *Avaya IP Telephony Implementation Guide*, COMPAS ID 95180, July 2005

Product documentation for Juniper Networks products may be found at http://www.Juniper.net

[5] *CLI User Guide (JUNOS Internet Software for J-series, M-series, and T-series Routing Platform) Release7.6*, Part Number 530-015682-01, Revision 1
[6] *JUNOS Internet Software for J-series, M-series, and T-series Routing Platforms, Class of Service Configuration Guide Release 7.6*, Part Number 530-015688-01, Revision 1
[7] *JUNOS Internet Software for J-series, M-series, and T-series Routing Platforms, Network Interfaces Configuration Guide Release 7.6*, Part Number 530-015687-01, Revision 1
[8] *JUNOS Internet Software for J-series, M-series, and T-series Routing Platforms, Services Interfaces Configuration Guide Release 7.6*, Part Number 530-015687-01, Revision 1

Product documentation for Cisco Systems products may be found at http://www.cisco.com

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